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in the second part, and in the third many subordinate subjects. Our space will not allow us to do justice to the erudition of this great work, but we can, perhaps, exhibit its scope so that those who are interested in the circumstances which gave birth to the progenitors of our modern institutions may understand how rich a storehouse of learning has been provided for them.

The writer begins with the study of the now venerable words, *studium generale* and *universitas*. Both terms were in vogue as early as 1300. The former phrase has not been found in use as the name of a high school prior to 1233-34, when it is applied to the school of Vercelli: the phrase *studium universale* is a little older. *Universitas* (as other writers, following Du Cange or the lexicographers, have pointed out) had originally no special reference to a seat of learning. It signified very nearly what we call a corporation, and was almost synonymous with such words as *societas*, *collegium*, *corpus*, *communio*, *consortium*. Gradually it came to be employed for the corporation devoted to the pursuit of knowledge, and then was restricted to this use, so that *universitas oxoniensis* was interchangeable with *studium oxoniense*; but the proper designation of a mediaeval high school was *studium generale*, or *studium* alone. As early as 1254, the word 'university' is used in Paris as equivalent to 'college.' The definition of Hugolinus is worth quoting: 'Universitas est plurium corporum collectio inter se distantium uno nomine specialiter eis deputato.'

From this preliminary inquiry, the writer proceeds to the history of the universities of Paris and Bologna, which, in his view, require more elaborate treatment than the other high schools, not only because of their extraordinary direct influence, but because their constitution is the key to that of many later foundations. The school at Salerno, older than the two just named, was quite subordinate in general influence. Savigny's theory that universities, by a sort of natural evolution, were developed around the chair of an illustrious teacher, is vigorously opposed by Denifle, who recognizes many factors as co-working in the origin of an enduring university. New methods of instruction, and privileges accorded by authority, seem to our author most potent influences; but even more important was the forming of corporations for the promotion of study, or, in other words, the introduction of combined or co-operative methods of instruction. The different modes in which such combinations were secured in Paris and Bologna are discussed at much length. After considering the origin of these typical foundations, in whose usages of five or six centuries ago may be found the germ of customs

and laws still recognized, even in the disjointed members of American universities, the author takes up, one by one, all the other European universities of the period he is considering. He makes four groups,—schools, improperly called universities; high schools without letters of authorization; high schools which were established by papal briefs; and high schools which received their privileges from papal and princely authority. Finally, the relation of universities to pre-existent schools is very fully discussed.

We have said enough to show that the writer is original, and to a considerable degree controversial. Whatever criticism his views may call forth,—and they are likely to be most closely scrutinized in Germany,—his diligence in the collection of facts, his comprehensive views, and his abundant references to original authorities, entitle him to the highest praise. There is good reason to think that he is right in claiming that the period he is discussing, instead of belonging to the age of darkness, is one of those epochs when the mind of man has received new impulses of unusual and persistent force.

THE WASHBURN OBSERVATORY.

THE third volume of the 'Publications of the Washburn observatory,' lately issued, gives the results of the work of 1884. About 1,800 observations were made with the Repsold meridian-circle upon the gesellschaft southern fundamental stars and the Leyden Cape of Good Hope refraction-stars. The instrumental constants are given for each observing day, and an investigation of the zenith-distance micrometer-screw and of the horizontal flexure of the instrument. In the cold winter weather of Wisconsin the micrometer-springs turned out too weak to pull the slides, and had to be replaced with stiffer ones. The probable error of a single declination is now reduced to 0".4, a great improvement over that noted in vol. ii.; and a correction of $+0".30 \pm 0".026$ to the constant of the 'Pulkowa refractions' seems to be called for by the observations of 1884 to suit the atmosphere over Madison. Professor Holden expresses his continued satisfaction with the Repsold meridian-circle, and appears to be making a very thorough study of it; and in this his example might well be followed with profit by some of our older established observatories. Two determinations of the latitude by Mr. G. C. Comstock are given,—one from Professor Holden's and his own observations with the zenith-telescope, the other from his own with the prime-vertical transit, using both reflected and direct observations; the declina-

tions in both cases being those of Auwers' system. They come out respectively —

$$+ 43^{\circ} 4' 36''.97 \pm 0''.07$$

and

$$36''.99 \pm 0''.06,$$

remarkably accordant results. The fifth part of the volume is a 'Catalogue of 1,001 southern stars for 1850.0, from observations by Signor P. Tacchini, at Palermo, in the years 1867, 1868, 1869,' by Rev. Father Hagen, S.J., and Edward S. Holden. The original observations had never been reduced to mean place; but being good ones, and in a part of the sky where needed, we have here the anomaly of European work reduced and published in this country; and Father Hagen and Professor Holden are to be highly commended for making it available, while its comparison with Oeltzen's Arge-lander (south) and the Washington zones served to detect many errors in these catalogues. The sixth part gives the observations of 437 southern stars made with the Washington transit-circle, and also the position of the same stars (whenever occurring) from the catalogues of Yarnall, Gould's zones, and Stone, all the positions being reduced to 1850.0 by Father Hagen. This is the first opportunity for easy comparison on a large scale between these four systems of southern declinations, and the comparison develops the following important differences of north polar-distance:—

Yarnall	= + 1''.12 (from 220 stars)
Gould (Z.C.)	= + 1''.96 (" 215 ")
Stone	= + 1''.00 (" 238 ")

It is a rather unexpected anomaly to find the Cordoba zone-catalogue and Stone differing by nearly a second, but that the Washington transit-circle should be so much out will not probably occasion much surprise to any one.

The volume closes with a count of the *Durchmusterung* stars between -2° and $+13^{\circ}$, a determination of the constants of some of the other instruments, meteorological observations for 1884, a summary of the same as taken at Madison continuously from 1853 to 1884, and is throughout a highly creditable publication. In his new field at the Lick observatory, Professor Holden will have the satisfaction of having left behind a valuable monument in these three volumes.

ARTIFICIAL WINDS.

A NOVEL apparatus has been constructed by M. Rougerie, a priest of Pamiers, in France, and brought recently before the French academy of sciences. It gives rise to air currents similar to the great winds of the earth's atmosphere, and hence its name, the *anémogène*. As described in *Engineering*, the apparatus consists of a small artificial terrestrial globe put into rapid rotation

in the surrounding air. In fact, it is a miniature of the earth, and by its rapid rotation it gives rise to air currents resembling the trade and other dominant winds of the world. These currents are shown by girouettes placed round the globe at small intervals, like the wind marks on the French marine charts. The apparatus reveals the following facts: The north-east and south-east trades are reproduced, and the equatorial zone of calms caused by their meeting. The gentle breezes from north and south, which disturb the equatorial calms, are also seen. So is the overthrow of the north-east trade in the south-west monsoons in the gulfs of Oman and Bengal. An ascending current in the equatorial regions is shown, and a descending current near the Azores under the centre of maximum barometrical pressure of the North Atlantic; also a descending current is indicated between St. Helena and the meridional coast of Africa, under the centre of maximum barometric pressure of the South Atlantic. At the poles there is a current descending from the zenith. The south-east trade at the Canaries is represented, while at the same time a south wind blows at the summit of the Peak of Teneriffe. Ascending currents from the east and west over Central America combine with the upper returning current of the north-east trade, thus explaining how the ashes of the volcano of Consequina, on Lake Nicaragua, were transported to Jamaica during the eruption of the 25th of February, 1835. Owing to the defects of construction, the *anémogène*, however, does not reproduce in a perfect fashion the variable winds between the tropic of Cancer and 50° N. lat., nor the corresponding winds between the tropic of Capricorn and 50° S. lat. In the same way the south-west and north-west winds of 50° N. and S. lat. are not very faithfully imitated.

EVERY student of biology knows of Huxley and Martin's 'Elementary text-book of biology.' Most teachers have either used the book, or been influenced by it in forming or modifying their laboratory courses. But the lack of illustrations, and brevity of the text, made the book to many almost useless. Mr. Howe's atlas (*Macmillan*) is intended to supplement the text-book in the first of these particulars. Its plates show the student exactly the points to which the text refers. It is a series of twenty-four large plates containing some five hundred figures. Each plate is accompanied by two or three pages of explanation, and the work closes with a few admirable practical directions and a bibliography. In anatomical accuracy the book is all that any one could reasonably desire. The figures, however, differ greatly in clearness and finish.